LEVEL II

EEO GOALS DEVELOPMENT
IN THE NAVAL SEA SYSTEMS COMMAND

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A realistic EEO goals development must consider factors which affect both external and internal labor pools as well as work load requirements and management constraints associated with specific jobs. The U.S. Navy has been investigating such methodologies since 1975. A critical phase is to determine the usefulness of such a comprehensive methodology is the prototype testing in a sufficiently large segment of the operating organization. This report describes the first phase of such a test in the Naval Sea Systems Command (NAVSEA) covering 100,000 employees in 22 local labor markets.

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LEVEL II

RESEARCH REPORT NO. 35

EEO GOALS DEVELOPMENT
IN THE NAVAL SEA SYSTEMS COMMAND

by

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Introduction

A realistic EEO goals development must consider factors which
affect both external and internal labor pools as well as workload
requirements and management constraints associated with specific jobs.
The U.S. Navy has been investigating such methodologies since 1975. A
critical phase to determine the usefulness of such a comprehensive
methodology is the prototype testing in a sufficiently large segment of
the operating organization. This report describes the first phase of
such a test in the Naval Sea Systems Command (NAVSEA) covering 100,000
employees in 22 local labor markets.

The Navy research program, supported by the Naval Personnel Research
and Development Center, has resulted in a number of models as described
by Charnes, Cooper, Lewis, and Niehaus [2]. Also, attention has been
paid to the external labor market with particular attention to available
labor pools as discussed by Atwater, Niehaus, and Sheridan [1]. All of
this is being integrated into a comprehensive computer support system as
described by Niehaus [4], which has been named the EEO Goals Model
System (EEOGMS).[1]

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[1] EEOGMS is part of a larger system called the Computer-Assisted
Manpower Analysis System (CAMAS) which is designed to support civilian
personnel planning throughout the Navy.

NAVSEA was selected as the test organization as the result of the request and enthusiastic endorsement of VADM Bryan, Commander, NAVSEA. The intent was to test a bottom up system of goal development coupled with a top down system of management control. Three phases of the test have emerged. The first involves the testing at a limited number of local labor markets and NAVSEA facilities to develop and test the computer support system. The second phase is the extension of these calculations to all the larger labor markets of NAVSEA. The final phase involves testing the goals process from the complete command point of view including interactions with the central Navy EEO office. This report emphasizes the first phase with a description of the processes to be tested during the latter phases.

System Description

A summary of the EEO goals system is provided in Figure 1. As discussed in Atwater, Niehaus, and Sheridan [1], this system starts with a sample of accession data from recent periods to assist in the determination of the geographic area to be considered for each job class.[2] The job classes are defined by occupation and grade/level groupings (including factors such as wage compensation, education standards, etc.) such that the national, regional, or local characteristics of the relevant labor

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[2] See also Haber and Gastwirth [5] which suggests a similar procedure for specifying the labor market for individual firms.

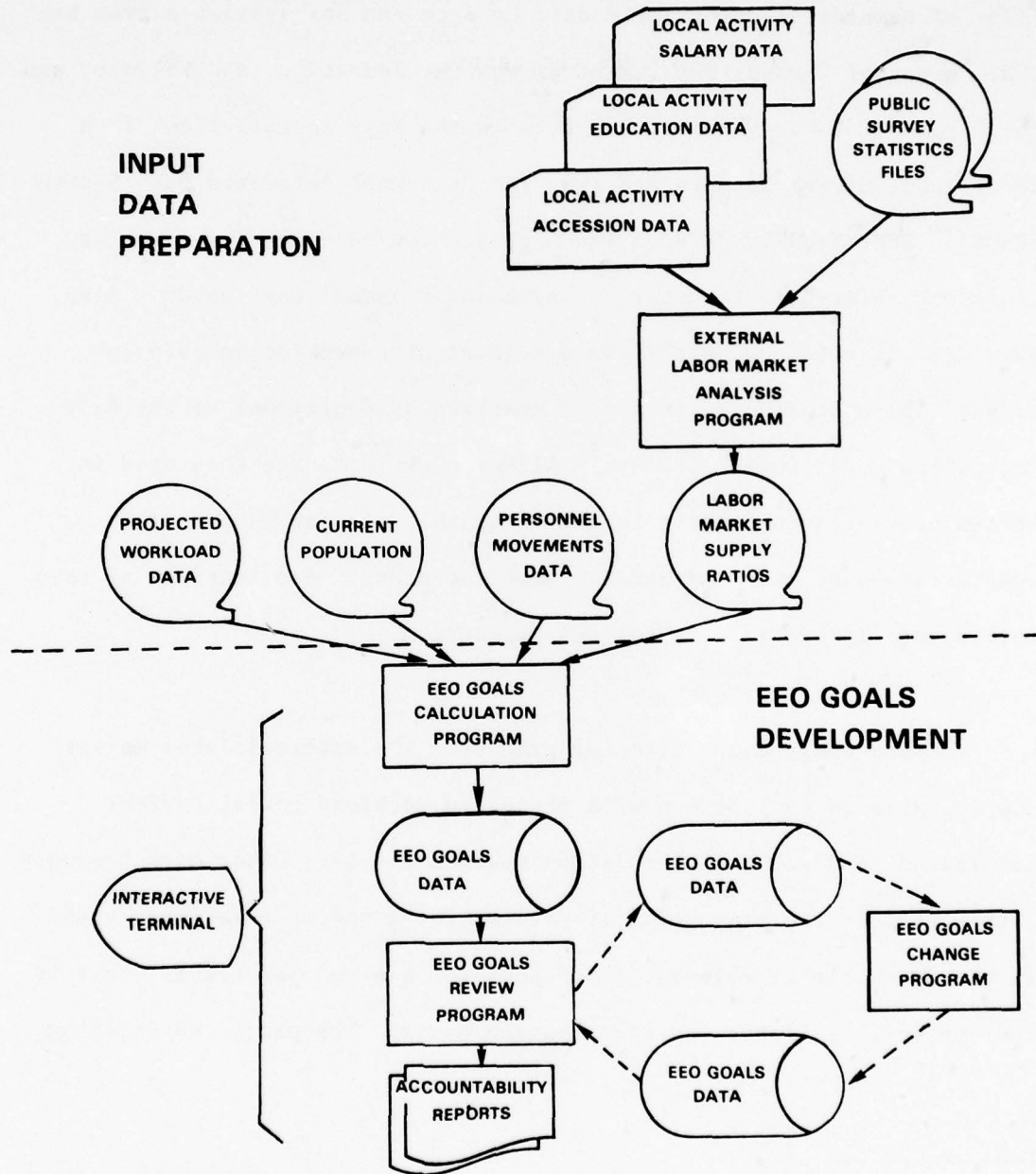# EQUAL EMPLOYMENT OPPORTUNITY
GOALS MODEL SYSTEM (EEO GMS)

FIGURE 1

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market for each job class is preserved. The geographic areas for each of the job classes are shown in Figure 2. These defined geographic areas are then used to select the relevant data from various computerized files of samples of demographic data by race and sex available from the U.S. Bureau of Census, Department of Health, Education, and Welfare, and the Bureau of Labor Statistics. Data on the Navy installations in a local labor market is obtained from the Personnel Automated Data System (PADS). Specifically data on the high and low salaries for each job class are referenced to determine each job classes' wage bands. Also, Navy data is obtained on the average level of education in each job class. The occupational data is summarized by Department of the Navy Occupation Level (DONOL) codes.[3] All of these data are then used in a series of regression models to determine the relevant labor market supply ratios by race and sex for each job class. A discussion of this methodology is provided in [1] and Appendix A.

The EEO goals calculation program uses the external labor market supply ratio in conjunction with projected workload goals, current population, and internal population movements data. Labor market supply ratios reflect the proportion of persons for a specific race-sex group in the available or relevant labor pool for a given job class. This is done on an installation by installation basis. The projected workload

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[3] See Secretary of the Navy Instruction (SECNAVINST).12280.9 of 31 Oct 1977.

	SCIENTISTS AND ENGINEERS	OTHER PROFESSIONAL	ADMIN-ISTRATIVE	TECHNICAL	CLERICAL	OTHER
GS 1-4	—	—	—	LOCAL HIGH S/EQ.	LOCAL HIGH S/EQ.	LOCAL HIGH S/EQ.
GS 5-8	NATIONAL COLLEGE/EQ.	NATIONAL COLLEGE/EQ.	LOCAL/REGIONAL HIGH S/VOCAT/COLLEGE/EQ.	LOCAL/REGIONAL HIGH S/VOCAT/EQ.	LOCAL HIGH S/EQ.	LOCAL HIGH S/EQ.
GS 9-12	NATIONAL COLLEGE/EQ.	NATIONAL COLLEGE/EQ.	REGIONAL VOCAT/COLLEGE/EQ.	REGIONAL VOCAT/EQ.	LOCAL VOCAT/EQ.	LOCAL VOCAT/EQ.
GS 13-15	NATIONAL GRADUATE/EQ.	NATIONAL GRADUATE/EQ.	NATIONAL GRADUATE/EQ.	REGIONAL VOCAT/EQ.	—	—
GS 16-18	NATIONAL GRADUATE/EQ.	NATIONAL GRADUATE/EQ.	NATIONAL GRADUATE/EQ.	—	—	—

(SIMILAR TYPE OF CRITERIA USED FOR UNGRADED WORKFORCE—LABOR MARKET IS LOCAL)

U. S. NAVY GEOGRAPHIC AND EDUCATIONAL CRITERIA FOR LABOR MARKET SUPPLY RATIOS

FIGURE 2

by job class is obtained by multiplying the total projected manpower ceiling in five years by the current percentage of personnel in each of the job classes. The intermediate years are interpolated. The current population and personnel movements data are obtained from PADS.[4]

The first step in the goals calculation process for most of the job classes is the multiplication of the work load requirements by the labor market supply ratios. Then, a series of goals adjustment calculation rules are used as summarized in Figure 3. These rules strike a balance between what is required for strictly legally defensible goals and the need to impart an affirmative action approach to EEO planning. For example, no race-sex category is singled out such that the rules themselves are discriminatory. The goal adjustment rules are provided in their entirety in Appendix B.

As indicated on Figure 3, for white collar job classes with fewer than twenty jobs, the only adjustments that are made are for the change in the workforce requirements in the job classes affected. For the remaining white collar job classes, various additional adjustments are made. The external labor market supply ratio by race and sex for each

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[4] At a later date this goals calculation program will be replaced by a goal programming model which will provide considerably more information concerning the internal labor market and EEO planning. See Charnes, Cooper, Nelson, Lewis, and Niehaus [3].

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GOAL ADJUSTMENTS
FOR INTERNAL LABOR MARKET

WHITE COLLAR

1-19

- CURRENT INCUMBENTS MODIFIED BY WORKFORCE CHANGE

OTHER

- AVAIL LABOR POOL × WORKFORCE REQ MODIFIED BY ATTRITION FOR CATEGORIES OVER GOAL
- ROUND UP 20-50
- ROUND OFF 50 +
- RESIDUALS ON FAIR-SHARE BASIS

BLUE COLLAR

CRAFTSMEN & OPERATIVES

- APPRENTICES-USE AVAIL LABOR POOL × WORKFORCE REQ
- HELPERS-USE WHITE COLLAR RULES
- JOURNEYMEN-TREAT AS INTERNAL LABOR MARKET
- LEADERS & SUPERVISORS-INTERNAL LABOR MARKET ACCELERATED FOR AFFIRMATIVE ACTION

GARDENERS & LABORERS

- USE WHITE COLLAR RULES

FIGURE 3

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job class is multiplied by the workforce requirements. A check is then made with the current on-board (in place) population to see which race-sex groups are over goal. For those that are over goal, they are reduced in most cases no more than one-half the cumulative attrition rate for the five year period. This ensures the possibility for hiring in all race-sex groups assuming that there are vacancies.

Particular attention is paid to the rounding rules. If normal round off procedures are used for job classes with a workforce requirement between 20-50, those race-sex groups with small external labor market supply ratios would never be included. For example, if the total number of jobs are 30 and the labor market supply ratio is one percent, by normal rounding the goal would be zero since 30 multiplied by .01 equals 0.3 which is less than 0.5. To overcome this problem and ensure an affirmative action approach, the number is rounded up rather than rounded down when the work force requirement is 20-50 jobs and the external labor market supply ratio is two percent or less. Thus, in the example the 0.3 would be rounded up to equal 1.0. Normal rounding procedures are used for job classes with 50 or more jobs.

The final adjustment involves forcing the total for all race-sex groups to equal the work force requirement. Residuals for the white collar personnel in most cases involve only one or two jobs. They are allocated so as to minimize the maximum deviation.

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In the blue collar area, additional adjustment procedures are necessary because the external and internal labor market employment and job advancement opportunities do not match. For the apprentice jobs the goals are set at the values obtained from multiplying the available labor supply ratios by the work force requirements. The rationale for this is that the goals are for five years in the future and the apprentices are hired for at most a four year program. Attrition thus should be 100%. The helper or semi-skilled jobs are adjusted in the same way as for the white collar area.

The journeymen adjustments are made through a combining of affirmative action with accounting for normal entry through the internal labor market. First a check is made comparing the current on-board populations with the goals as would be obtained using the external labor market supply ratios. For those race-sex groups over goal the attrition calculations as developed for the white collar jobs are used. For those race-sex groups under goal, the adjustment consists of the number currently on-board plus all those expected to become journeymen as determined by historical promotion statistics. This ensures that the progress to date is maintained plus an additional requirement is provided for which is consistent with the dynamics of the internal labor market. The residuals in this case are spread to the categories over goal on the basis of the external labor market supply ratios.

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The blue collar leader and supervisor goals also require additional adjustments. The assumption was made that the current on-board journeymen are the available labor pool for the leader and supervisor jobs. However, the historical promotion rates are so low that it would be many years before those minorities and women that are currently journeymen would have an opportunity for a proportionate number of the leader and supervisor jobs. In order to provide for affirmative action, it is assumed that the journeymen in each race-sex group will have a proportionate share of the leader and supervisor jobs five years in the future. Operationally, this is accomplished by first developing the pool percentage of leaders and supervisors in relation to journeymen. The pool percentage is then multiplied by the number of journeymen in each race-sex group. The resulting number is then further subdivided into leaders and supervisors filling the leader jobs first.

As an example, assume that the total number of journeymen at an installation is 1000, the total number of leaders is 300 and the total number of supervisors is 100. The pool percentage is then 400/1000 or 0.40 with leaders constituting 75 percent and supervisors 25 percent of the pool. If the Hispanic male journeymen category currently contains 50 individuals, then in five years the goal for Hispanic male leaders would be 15 (i.e., 50 x 0.40 x 0.75) and for supervisors would be 5 (i.e., 20 - 15). The residuals for the leader and supervisor categories are treated the same as they are for the journeymen category.

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The gardeners and laborers categories are processed using the same rules as developed for the white collar employees. In this case, there are employees only in the helper and supervisor career levels.

Changes to the EEO goals can be recommended by the local installation to reflect conditions known only to the local installation involved. The changes must be approved by the next organizational level in the hierarchy, which is the level by which the changes themselves are to be entered into the computer files. It will be required that copies including the written justification of all changes that are made be sent to the central headquarters organization coordinating the goals program. An interactive computer support system is being provided to the headquarters commands to permit ease of change and timeliness of action. This also ensures the continued involvement of the headquarters commands in the goals process. Once the goals have been agreed upon, a series of accountability reports are developed for management control. Hard copy reports are to be used for providing data to the field installations.

In the next phase of the prototype process, the guidelines for making locally determined changes will be tested. In order to ensure consistency at the headquarters levels, changes to the definitions of the job categories and other data elements used in the development of the goals will not be permitted. Also, the labor market boundaries will be determined centrally. Changes to the goals will be permitted to allow for such reasons as a sub-unit being physically in another location.

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A written statement documenting the reason for the proposed change including the methodology used will be required in order to obtain approval to make the change. An extremely narrow view will be taken of what constitutes business necessity or a bona fide occupational qualification (BFOQ) which would exempt a Navy employer from the need to consider all applicants equally in employment.

Installation Level Tests

It is well to begin looking at the test results to see how the EEO goals system works in practice. The results presented in this report will focus on one NAVSEA installation. The actual installation is identified simply as NAVSEA Installation No. 1 since the results are experimental. Installation No. 1 is a large industrial facility which draws its workforce from parts of two large Standard Metropolitan Statistical Areas (SMSA's).

The first task at hand was to identify the geographic area to be considered for each of the job class categories which are designated as part of the local labor market.[5] Department of the Navy Occupation Level (DONOL) Category 2 (Scientists and Engineers) and 3 (Other Professional) were not analyzed since they relate to a national labor

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[5] Although regional geographic areas are specified in Figure 2, such areas were not studied in this test.

market. Also DONOL Category 7 (Other General Schedule) was not used

since there were very few employees in that category at Installation

No. 1. Various data were collected on a sample of applicants for 1976

and 1977 including Zip Code at time of application, occupation and

grade/level of job obtained, education at time of application, as well

as identification data. The data was then matched by a computer program

to a dictionary of Zip Codes by county provided by the Postal Service.

The results in Figure 4 show that some counties provided different types

of workers than others. For example, applicants for occupations 5, 6

and 8 (technicians, clerical and blue collar craftsmen) were obtained

from County C while County D provided applicants for all the local

related occupations. Also, not shown is the elimination of one very

large county which, if included, would have resulted in a change in some

of the external labor market supply results. This county, which is

approximately 40 miles from Installation No. 1, was eliminated since

less than 2% of the local new hires are obtained from this source in the

defined two year period.

With the local geographic area identified, data was collected on

the wage bands for Navy job classes in 1970 and 1978. Also, educational

data was developed using data collected in 1976 for the U.S. Civil

Service Commission. The educational data represents a sample of approx-

imately 60% of the work force. These Navy data were matched against

data from the 1970 Census, 1976 Survey of Income and Education (SIE) of

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NAVSEA INSTALLATION NO. 1

ACCESSIONS - (1976-1977)
Labor Market Area: LOCAL

COUNTY LISTS FOR SINGLE DIGIT

DONOL GROUPS	4	5	6	8	9	TOTAL
A	2	2	2	92	1	(99)
B	1	5	5	87	1	(99)
C		2	4	20		(26)
D	6	16	39	118	3	(182)
E	5	53	150	521	16	(745)
F	1	5	8	41		(55)
Subtotal (N_i)	15	83	208	879	21	(1206)
Total # Accessions (t_i)	22	120	219	1054	22	(1437)
Percent (N_i/t_i)	68.2	69.2	95.0	83.4	95.5	83.9

FIGURE 4

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the Department of Health, Education and Welfare, and the Current Population Survey (CPS) of the Department of Labor. The analysis was done using a series of regression models and projected in the future to obtain the external labor market supply ratios for 1983. An example of the supply ratios is shown in Figure 5.

The next step was to match the external labor market data with the projected workload and internal labor market data. The first step is to obtain the workload requirements as shown in Figure 6. In this case a simple proportionalization routine was used. However, these data could be replaced with data from the best available source--such as a workload standards system, simulation, etc. Using the rules provided in Figure 3, the goals for Installation No. 1 were calculated. These data were also calculated by hand to ensure there were no computer programming errors in the computational routine. A sample of the EEO Goals report is shown in Figure 7. This data is fed into an accountability report which shows both the near term (i.e., one year later) and the longer term (i.e., five years) goals and compares them with the current population. An example of part of this report is shown in Figure 8.

Comparison with Population Parity Methods

The official Navy goals policy at the time of the study was stated in terms of the available labor supply. Operationally, however, this has resulted in the use of population parity methods concentrating on

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LABOR MARKET SUPPLY RATIOS FOR 1983

NAVSEA INSTALLATION NO. 1

MAJOR OCCUPATION	LEVEL	% MALE	MALE BREAKOUT				% FEMALE	FEMALE BREAKOUT			
			WHITE	BLACK	HISPANIC	OTHER*		WHITE	BLACK	HISPANIC	OTHER*
SCI & ENG	GS 5-8	88	74	3	4	7	12	6	2	2	2
SCI & ENG	GS 9-12	91	80	2	2	7	9	3	2	2	2
SCI & ENG	GS 13-15	92	80	2	3	7	8	2	2	2	2
OTHER PROF	GS 9-12	75	68	3	1	3	25	19	2	2	2
OTHER PROF	GS 13-15	75	60	2	2	3	25	19	2	2	2
MANAGERS & ADMIN	GS 5-8	64	54	3	2	3	36	30	2	2	2
MANAGERS & ADMIN	GS 9-12	85	78	1	2	4	15	12	1	1	1
MANAGERS & ADMIN	GS 13-15	89	80	2	3	4	11	5	2	1	2
SUB PROF & TECH	GS 1-4	72	66	2	2	2	28	22	2	2	2
SUB PROF & TECH	GS 5-7	84	73	1	1	9	16	13	1	1	1
SUB PROF & TECH	GS 9-12	89	71	2	6	10	11	5	2	2	2
SUB PROF & TECH	GS 13-15	92	86	2	2	2	8	2	2	2	2
CLERICAL	GS 1-4	8	4	2	1	1	92	84	4	3	1
CLERICAL	GS 5-8	10	6	2	1	1	90	83	3	2	1
CLERICAL	GS 9-12	23	18	1	3	1	77	72	1	1	1
CRFTSMN-OPERATIONS	APPRENT	90	74	10	4	2	9	6	1	1	1
CRFTSMN-OPERATIONS	SEMI-SKT	91	75	8	6	2	9	6	1	1	1
CRFTSMN-OPERATIONS	JOURNYMN	93	76	8	7	2	7	4	1	1	1
CRFTSMN-OPERATIONS	LEADERS	94	70	8	6	1	6	3	1	1	1
CRFTSMN-OPERATIONS	SUPERVRS	94	70	8	6	1	6	3	1	1	1
LABORERS	SEMI-SKT	92	86	2	2	2	8	2	2	2	2

* INCLUDES ORIENTAL AND AMERICAN INDIAN

FIGURE 5

EXPERIMENTAL REPORT

NAVSEA INSTALLATION NO. 1

WORK LOAD REQUIREMENT FOR 1983

OCCUPATIONAL CLASS AND ITS DCNQL CODE	GS 1-4	GS 5-8	GS 9-12	GS 13-15	GS 16-18	TOTAL
2 SCI & ENG	0	42	493	88	0	623
3 OTHER PROF	0	0	11	2	0	13
4 MANAGERS & ADMIN	0	25	176	34	0	235
5 SUB PROF & TECH	20	205	508	6	0	
6 CLERICAL	405	205	2	0	0	
7 SERVICE	11	3	0	c	c	

	APPRENT	SEMI-SKI	JOURNYMN
8 CRFTSMN-OPERATICNS	945	1,149	3,511
9 LABORERS	0	54	

EXPERIMENTAL REPORT

FIGURE 6

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PROJECTED EEO GOALS FOR 1983

NAVSEA INSTALLATION NO. 1

CODE	NAME	LEV	WHITE MALE	BLACK MALE	HISP MALE	OTHER MALE	WHITE FEML	BLACK FEML	HISP FEML	OTHER FEML	TOTAL
2	SCI & ENG	1	0	0	0	0	0	0	0	0	0
2	SCI & ENG	2	30	1	2	3	3	1	1	1	42
2	SCI & ENG	3	390	10	10	38	15	10	10	10	493
2	SCI & ENG	4	69	2	3	6	2	2	2	2	88
2	SCI & ENG	5	0	0	0	0	0	0	0	0	0
3	OTHER PROF	1	0	0	0	0	0	0	0	0	0
3	OTHER PROF	2	0	0	0	0	0	0	0	0	0
3	OTHER PROF	3	6	0	0	1	4	0	0	0	11
3	OTHER PROF	4	2	0	0	0	0	0	0	0	2
3	OTHER PROF	5	0	0	0	0	0	0	0	0	0
4	MANAGERS & ADMIN	1	0	0	0	0	0	0	0	0	0
4	MANAGERS & ADMIN	2	7	3	0	0	15	0	0	0	25
4	MANAGERS & ADMIN	3	134	4	4	7	21	2	2	2	176
4	MANAGERS & ADMIN	4	26	1	1	1	2	1	1	1	34
4	MANAGERS & ADMIN	5	0	0	0	0	0	0	0	0	0
5	SUB PROF & TECH	1	10	1	1	1	4	1	1	1	20
5	SUB PROF & TECH	2	136	6	5	15	33	6			
5	SUB PROF & TECH	3	360	18	29	49	24	9			
5	SUB PROF & TECH	4	6	0	0	0	0	0	0	0	
5	SUB PROF & TECH	5	0	0	0	0	0	0	0	0	0
6	CLERICAL	1	19	7	4	4	320				
6	CLERICAL	2	12	3	2	2	166				
6	CLERICAL	3	3	1	0	0	1	0	0	0	
6	CLERICAL	4	1	0	0	0	0	0	0	0	
6	CLERICAL	5	0	0	0	0	0	0	0	0	0
7	SERVICE	1	5	5	1	1	0	0	0	0	
7	SERVICE	2	2	2	0	0	0	0	0	0	
7	SERVICE	3	0	0	0	0	0	0	0	0	0
7	SERVICE	4	0	0	0	0	0	0	0	0	0
7	SERVICE	5	0	0	0	0	0	0	0	0	0
8	CRFTSMN-OPERATIONS	1	707	95	39	0	0				
8	CRFTSMN-OPERATIONS	2	808	146	65	0	0				
8	CRFTSMN-OPERATIONS	3	2,702	313	230	0	0				
8	CRFTSMN-OPERATIONS	4	432	43	33	0	0				
8	CRFTSMN-OPERATIONS	5	621	73	47	0	0				
9	LABORERS	1	0	0	0	0	0				
9	LABORERS	2	30	12	0	0	0				
9	LABORERS	3	0	0	0	0	0				

EXPERIMENTAL REPORT

FIGURE 7

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EEO ACCOUNTABILITY REPORT

NAVSEA INSTALLATION NO. 1

HISP. MALE

OCCUPATION	LEV	ABOARD SEP 76	ABOARD SEP 77	GOAL SEP 79	DIFF SEP 79-SEP 77	GOAL SEP 83	DESIRED CHANGE BY SEP 83 DIFF	%AGE
SCI & ENG	2	1	0	1	1	2	2	***%
SCI & ENG	3	8	11	11	0	10	-1	-9%
SCI & ENG	4	1	1	2	1	3	2	200%
MANAGERS & ADMIN	3	6	8	7	-1	4	-4	-50%
MANAGERS & ADMIN	4	0	0	0	0	1	1	***%
SUB PROF & TECH	1	1	0	0	0	1	1	***%
SUB PROF & TECH	2	7	9	8	-1	5	-4	-44%
SUB PROF & TECH	3	17	15	19	4	29	14	93%
CLERICAL	1	0	2	3	1	4	2	100%
CLERICAL	2	0	0	1	1	2	2	***%
SERVICE	1	1	1	1	0	1	0	0%
CRFTSMN-OPERATIONS	1	45	48	43	-5	39	-9	-19%
CRFTSMN-OPERATIONS	2	60	61	60	-1	65	4	7%
CRFTSMN-OPERATIONS	3	153	170	183	13	230	60	35%
CRFTSMN-OPERATIONS	4	20	19	23	4	33	14	74%
CRFTSMN-OPERATIONS	5	29	32	36	4	47	15	47%
LABORERS	2	1	3	2	-1	1	-2	-67%
TOTAL HISP. MALE		350	380	400		477		

EXPERIMENTAL REPORT

FIGURE 8

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"significantly out of balance situations." Stated quantitatively, a job category is "out of balance" when the minority representation in the particular job category is less than 75% of that group's representation in the population or recruitment area. For professional jobs, where recruiting is nationwide, the 75% is computed on the United States population as a whole. For other occupations, the method of calculating recruitment areas was defined in an internal Navy instruction to be Standard Metropolitan Statistical Area (SMSA). This policy provided that a goal would be established for each significantly "out of balance" graded and wage level job category in which there were 20 or more employees.

A comparison was made between the available labor pool goals and population parity goals using the Navy formula.[6] This comparison could not be made exactly since there were differences in definitions of some of the categories. Also, the assumption was made that the population parity method was applicable to all categories since the majority of categories designed for use in the available labor pool methods contain more than 20 jobs. The current Navy policy inadvertently leaves out a large number of jobs due to the high level of specificity in defining the job categories with many having fewer than the required 20 jobs.

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[6] The available labor pool goals in this comparison do not reflect the described external labor market analysis. As described the goals reflect unadjusted occupation participation for defined race and sex groups.

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For the comparison the population percentages by race and sex used by Installation No. 1 were obtained from goal data incorporated as part of their official affirmative action plan. The race breakdowns as contained in that AAP are given in Figure 9. Also, the 15% figure for women in professional and high level occupation jobs and 25% women for regional and local jobs was used as contained on the AAP.

Data from the 1970 census was also obtained by occupation, race and sex for the labor market of Installation No. 1. This data is unadjusted for the reservation wage or the amount of money an individual requires in order to take the job.

Figures 10, 11 and 12 show comparisons of the different methods of computing the 1983 goals for NAVSEA Installation No. 1. The 1983 goals are specified in terms of number of positions. The comparisons are for mid-level jobs for the respective occupations paying between $15 and $30 thousand per year. The first bar shows the September 1977 actual on-board population. This is followed by the 1983 goals computed using the population parity method prescribed in the Navy in 1971. The next bar shows the goals using occupation data from the 1970 census. The final two bars (i.e., JC(E) and JC(A)) show the goals using job class parity. The first (JC(E)) is unadjusted for the internal labor market and the second (JC(A)) has the adjustments included.

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1971 NAVY EEO GOALS CALULATION - POPULATION PARITY METHOD

FOR

NAVSEA INSTALLATION NO. 1

.(From FY 1977 Affirmative Action Plan)

PERCENTAGE TABLE

	National	Regional	Local
By Sex			
Female	15.0	25.0	25.0
Male	85.0	75.0	75.0
By Race			
Black	11.2	8.2	4.7
Hispanic	5.0	3.5	6.6
Others	2.0	4.3	4.3
White	81.8	84.0	84.4
By Race and Sex (Combination of above)			
Black Female	1.68	2.04	1.18
Hispanic Female	.75	.88	1.64
Other Female	.30	1.08	1.08
White Female	12.27	21.00	21.10
Black Male	9.52	6.14	3.53
Hispanic Male	4.25	2.63	4.94
Other Male	1.70	3.23	3.23
White Male	69.53	63.00	63.30

EXPERIMENTAL REPORT

FIGURE 9

COMPARISON OF PARITY METHODS — 1983 GOALS
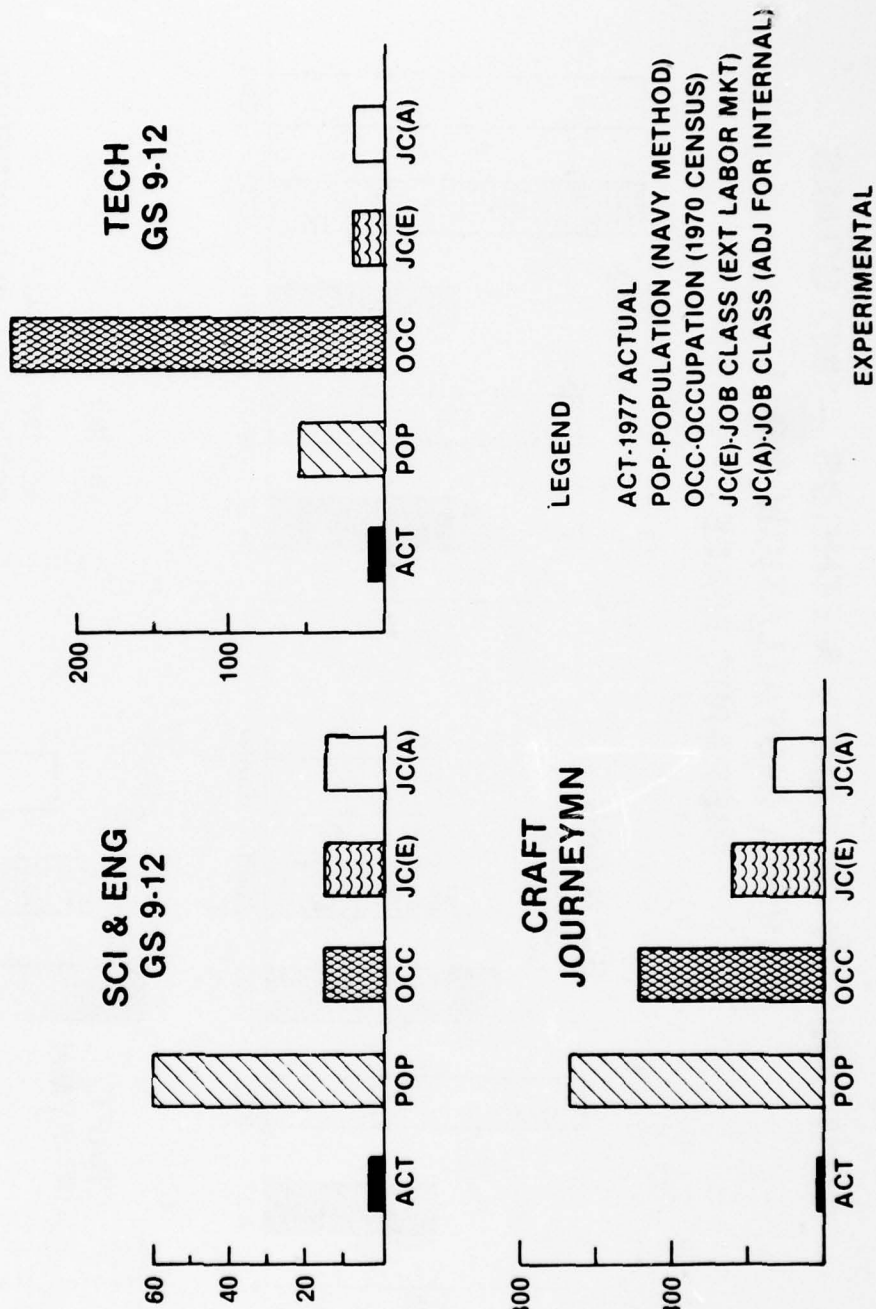## NAVSEA INSTALLATION NO. 1
WHITE FEMALE

TECH
GS 9-12

SCI & ENG
GS 9-12

CRAFT
JOURNEYMN

LEGEND

ACT-1977 ACTUAL
POP-POPULATION (NAVY METHOD)
OCC-OCCUPATION (1970 CENSUS)
JC(E)-JOB CLASS (EXT LABOR MKT)
JC(A)-JOB CLASS (ADJ FOR INTERNAL)

EXPERIMENTAL

FIGURE 10

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COMPARISON OF PARITY METHODS —1983 GOALS
NAVSEA INSTALLATION NO. 1
HISPANIC MALE

LEGEND

ACT-1977 ACTUAL
POP-POPULATION (NAVY METHOD)
OCC-OCCUPATION (1970 CENSUS)
JC(E)-JOB CLASS (EXT LABOR MKT)
JC(A)-JOB CLASS (ADJ FOR INTERNAL)

EXPERIMENTAL
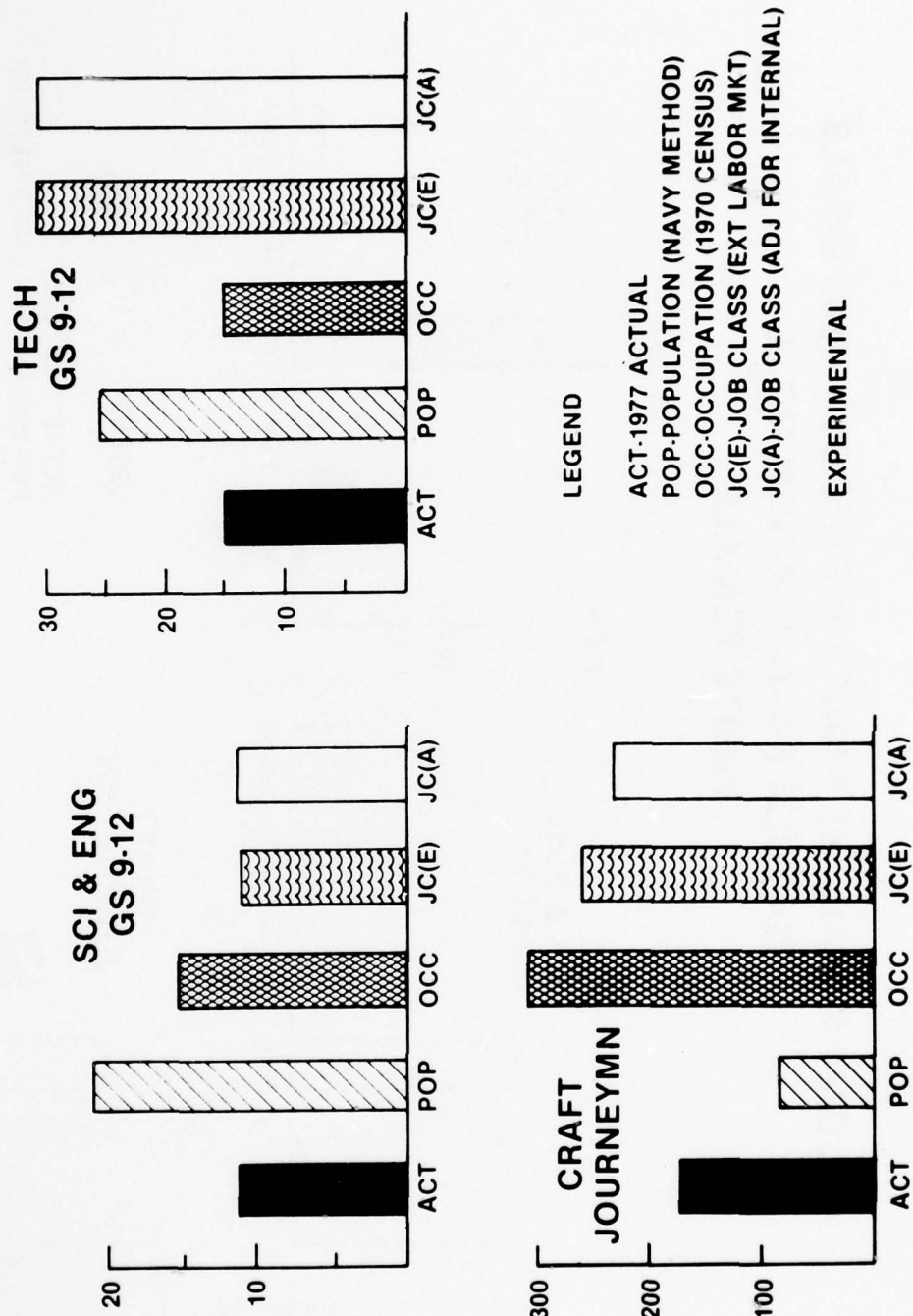
FIGURE 11

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COMPARISON OF PARITY METHODS —1983 GOALS
NAVSEA INSTALLATION NO. 1
BLACK MALE

TECH
GS 9-12

20

10

ACT   POP   OCC   JC(E)   JC(A)

SCI & ENG
GS 9-12

20

10

ACT   POP   OCC   JC(E)   JC(A)

CRAFT
JOURNEYMN

400

200

ACT   POP   OCC   JC(E)   JC(A)

LEGEND

ACT-1977 ACTUAL
POP-POPULATION (NAVY METHOD)
OCC-OCCUPATION (1970 CENSUS)
JC(E)-JOB CLASS (EXT LABOR MKT)
JC(A)-JOB CLASS (ADJ FOR INTERNAL)

EXPERIMENTAL
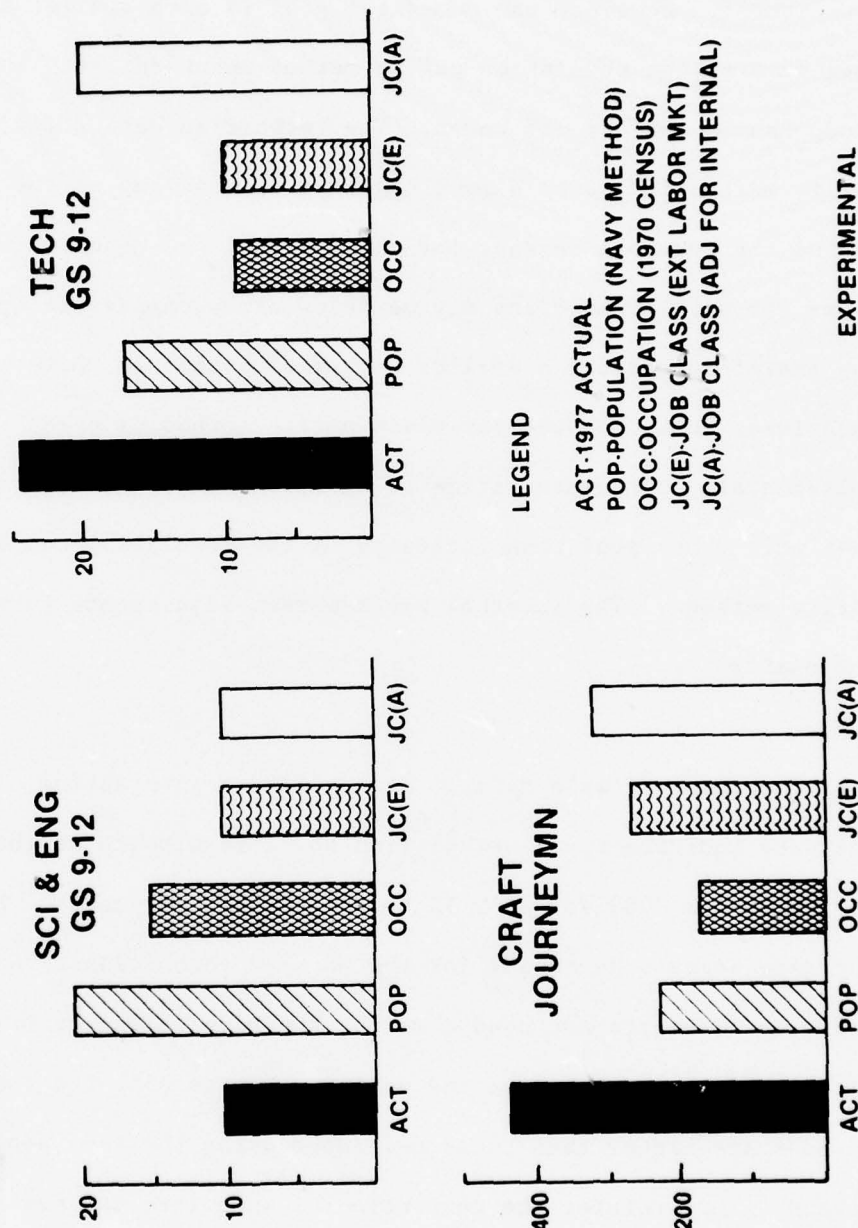
FIGURE 12

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The data in Figure 10 are for white females. It can be seen for GS 9-12 scientists and engineers that additional work is needed in recruitment. However, the numerical goal is much smaller than that suggested by the population parity method which reflects that this work group should contain 15% women. The technician data using the occupation parity method indicates a much higher goal than any of the other methods. One of the possible reasons for this is that the reservation and market wages for Navy technicians may be below other comparable opportunities and therefore produce a smaller number of available white women for technician jobs when the job class parity method is used. The blue collar craft journeymen estimates again show that fewer women are in the available labor pool than indicated by the population and occupation parity methods. The internal labor market adjustments further reduce the number.

The Hispanic male data in Figure 11 are interesting. For example, the data indicate that Installation No. 1 is already at the level indicated for 1983 for GS 9-12 scientists and engineers. However, a 50% increase appears necessary for the GS 9-12 technicians. Similarly, additional efforts are needed in the the blue collar crafts journeymen area. In both these areas the goals as computed by the job class parity methods are higher than those developed using the Navy population parity method. This refutes the contention of some that the new method would always result in lower goals.

The black male data in Figure 12 show that Installation No. 1 has been particularly successful in this area. As with the Hispanic males they are already at the goals in the GS 9-12 scientists and engineer job class. For both GS 9-12 technicians and craft journeymen the current on-board populations are greater than the goals computed by any method. The internal labor market adjustments for the job class parity method raise the goals above the amount indicated by any other of the methods.

Data similar to that computed for NAVSEA Installation No. 1 is being computed for all the large NAVSEA installations in some 22 labor markets. The preliminary findings from some of these labor markets show results along the same lines as Installation No. 1 with varying degrees of goal accomplishment. On the whole, NAVSEA has made substantial progress. However, attention is needed in the Hispanic area as well as towards the employment of women of all ethnic or race categories particularly in the technician and blue collar areas. These data were presented to the highest management levels in NAVSEA headquarters and to the installations concerned. The goals are being used to frame the areas of emphasis of future efforts.

Extensions and Future Possibilities

The availability of realistic goals permits a comprehensive approach to the management of equal employment opportunities. It also sets the proper perspective for the various kinds of analysis which are needed.

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A number of very interesting research possibilities also become immediately worth pursuing.

An extension which is underway is comparative analysis of the data for similar organizations. In NAVSEA this represents such studies as comparing shipyards, weapons stations, and large facilities in or near the same geographic location. These studies extend beyond simple comparisons. Data from other sources such as from periodic inspections and evaluation teams will be cross checked with the goals. Comments are being obtained from all interested parties including line management, EEO officials and outside interest groups. The result of all of this will then be used to formulate the method of incorporating the new goals information into the Navy's policy structure.

Plans are being formulated to extend the new goals methodology to the remainder of the Navy. This includes studies to see if there are sufficient differences between types of installations to require different labor market supply ratios for the same job classes in the same labor market. For example, because of wage differences, the characteristics of the labor force of a laboratory might be different than that of an industrial facility. In addition to the local labor markets, a set of supply ratios is to be developed for the country as a whole as it applies to the Navy. These data are useful for estimating the goals for the residual jobs from the small facilities which cannot

be obtained using the local rates. Also, they can be used in Navy-wide analysis for developing overall policy guidance.

Perhaps the best source of information as to refinements of the goals system will come from the actual operation of the system. For example, assumptions can be modified and the system streamlined if the same type of structural problem which the Navy cannot change shows up in multiple locations. Thus, the capability to allow locally proposed changes not only helps to pinpoint unique situations but also provides the necessary information to change the system itself.

The EEO goals studies have indicated the need for further studies of internal mobility. These studies are to be based on occupation with particular emphasis on identifying the places where upward mobility efforts would be most effective. The complete work force is to be examined including possible flows between white and blue collar occupations. This could lead to possibilities such as tailoring recruitment programs to reach larger percentages of the internal Federal work force. This would tend to provide more opportunities to women and other minorities who would like to enter blue collar occupations. Similarly, it would provide opportunities for blue collar workers to cross into white collar technician and administrative occupations. Currently, however, relatively higher compensation in blue collar occupations has reversed such a trend. In any event, knowledge of the goals is beginning to

bring focus on the opportunities for effective affirmative action through better management and upgrading of the current on-board population.

Research is continuing by Charnes, Cooper, Nelson, and Niehaus on the development of local organization design models for upward mobility planning. Several types of analysis will be done here. One approach will use the goals as developed from the goal adjustment algorithm and further refine the numbers to indicate possible internal transfers through the use of "bridge" positions and the like. Another will examine how the unadjusted job class parity goals might to adjusted using the model. Still another may involve the development of goals between major suborganizations such as departments or cost centers. Preliminary results indicate that some of these possibilities are computationally feasible. The primary concern is whether they are practical in an actual organizational environment.

The Navy's EEO goals project has reached the stage where the results are being readied for full scale implementation. This also has strengthened the research effort providing a sound platform for further exploratory efforts.

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APPENDIX A

AVAILABLE LABOR POOL METHODOLOGY*

DEFINITION OF AVAILABLE LABOR POOL (ALP)

The available labor pool, (ALP), provides the statistical ethno-
sexual profile against which the organizational profile is compared to
determine if discrimination exists in employment and personnel practices.
Simply stated, the use of statistics for the purpose of defending against
charges of employment discrimination is amply documented. The basic
assumption is that the composition of the population identified -- the
available labor pool -- is reflected in the employer's work force,
absent discrimination. In effect, the race-sex makeup of the ALP has
been treated as a distributive norm against which the makeup of the
employer's work force is measured. Given the results of such a compari-
son, an organization can establish goals to make up any observed defi-
ciencies for specific race-sex groups in selected job categories. Thus,
a critical element in any EEO goals setting process is the calculation
of the available labor pool data and a projection of these labor pools
into the planning period future.

* This methodology was developed by. D. M. Atwater and J. A. Sheridan.

MODEL PARAMETERS (STATISTICAL DESCRIPTION)

The Paradigm ALP model is based on a specific economic model of
labor participation. References to principal economic studies in this
area of research are provided in the Bibliography.

In this approach, the individual's decision of whether to partici-
pate in the labor force is characterized by two criterion variables: a
market wage offer and a reservation wage. The reservation wage is the
minimum wage necessary to induce the individual to enter the labor market.
Thus, the individual will be a participant in the labor force if the
market wage offer exceeds the reservation wage. By knowing how various
exogenous variables influence each of these wages the proportion of
individuals of any given demographic subgroup that would be available
for work at a given wage offer can be determined. Knowing the total
number of individuals in that group in a given locale, we can then
obtain estimates of the total available supply of labor for the group at
given wage rates. The statistical model is summarized by three
relationships or equations.

The first equation is the wage offer equation. The wage offer
is assumed to be determined by a set of observable factors (X_o) and a
set of unique unobserved factors, such as ability and quality of educa-
tion. In mathematical terms, the wage equation used in the Paradigm
model is:

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$$(1) \quad W_o = B'_o \cdot X_o + e_o$$

where: $W_o =$ market wage offer

$$X_o = \begin{cases} \text{age of person (in years)} \\ \text{years of education complexed} \\ \text{a sampling censor modifier } (\lambda) \\ \text{race (white, not-white)} \\ \text{predicted years of work experience} \\ \text{constant (1)} \end{cases}$$

$e_o =$ effects of unobserved factors.

The second equation is the <u>reservation wage equation</u>. Like the market wage equation there are both observed determinants of the wage (X'_1) and a set of unique unobservables such as tastes for leisure and non-market productivity. Again, in mathematical terms, the reservation wage equation used in the Paradigm model is:

$$(2) \quad W_1 = B'_1 \cdot X_1 + e_1$$

Where: $W_1 =$ reservation wage

$$X_1 = \begin{cases} \text{age of the person in years} \\ \text{race (white, not-white)} \\ \text{number of children ages 0-6} \\ \text{number of children ages 7-13} \\ \text{number of children ages 14-18} \\ \text{spouse's income} \\ \text{estimated market wage offer} \\ \text{constant (1)} \end{cases}$$

$e_1 =$ effects of unobserved factors.

The third and final equation is the <u>labor force participation equation</u>. D is a dicotomous decision variable which indicates the

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likelihood that a person would participate (accept) a particular full-time job. The participation decision is based on a well-specified comparison of the market wage offer for the job being analyzed and the person's reservation wage:

$$(3) \quad D = \begin{cases} 1 = \text{(Yes, will participate) if } W_o \geq W_r \\ 0 = \text{(No, will not participate) if } W_o < W_r \end{cases}$$

Persons whose decision is affirmative are said to be wage available for the specified job.[1]

_____

[1] This specification may be expanded when <u>several</u> job alternatives are being examined. The expansion is:

$$D_j = \begin{cases} 1 \quad \text{if } W_{m_j} \leq W_r \leq W_{u_j} \\ 0 \quad \text{if } W_{m_j} > W_r \quad \text{or} \quad W_{u_j} < W_r \end{cases}$$

and W_{m_j} = starting wage offer for job(j)

W_{u_j} = top wage offer for job (j)

W_r = reservation wage

It should be noted that a person's decision <u>not</u> to participate where ($W_{m_j} > W_r$) reflects both the availability of such a person for other jobs such as (k) where ($W_{m_k} \leq W_r \leq W_{m_j}$) and the unwillingness of the demanders of labor services to over-compensate workers whose level of desired or reservation wages is less than the starting wage for job (j). Thus while a person would not be available for job (j) he/she would be available and matched up with other jobs such as job (k) described above.

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For non-working persons current market wages cannot be obtained. Thus, both the reservation wages and market wage offers are estimated.[2/]

The statistical approach developed to calculate reservation wages assumes that the disturbance terms (e_o, e_1) from equations (1, 2) are normally distributed with mean zero and constant variance-covariance matrix. Under these assumptions if wages can be observed for all persons and if the unobservable determinants of market and reservation wages are uncorrelated then full distribution of reservation wages can be estimated with Probit analysis. Substituting the reservation wage equation into the participation equation the participation equation is rewritten as:

$$(4) \qquad D = \begin{cases} 1 & \text{if} & \dfrac{W_o - B'_1 \cdot X_1}{\sigma_1} > \dfrac{e_1}{\sigma_1} \\[2em] 0 & \text{if} & \dfrac{W_o - B'_1 \cdot X_1}{\sigma_1} < \dfrac{e_1}{\sigma_1} \end{cases}$$

With Probit estimates of $\dfrac{1}{\sigma_1}$ and $\dfrac{B'_1}{\sigma_1}$, estimates of B'_1 can be obtained and hence reservation wages.

2/ For a working person if his (her) current wage is less than the offered wage for a job then that person is said to be available for the specified job. Using the expanded criteria, if the working person's wage (W_1) is such that ($W_{m_j} \leq W_1 \leq W_{u_j}$) then such a person is said to be available for job (j).

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There are two data problems: that wages cannot be observed for non-working persons and that market and reservation wages are likely to move together. With particular regard to the latter, if working persons have high market wages and high reservation wages and non-working persons have low market wages and low reservation wages then the differences will not be adequately accounted for if only a subsample of working persons is used to estimate the parameters (B_1'). To account for both of these problems we must estimate wages for all persons in the sample. These estimates must be free of "selectivity bias." <u>Estimates of wages that are free of the "selectivity bias" problem can be obtained with a censored sample regression technique</u>. In the Paradigm model, estimates of the sampling censor modifier (λ) for each observation in the data is obtained using Probit analysis and a reduced-form labor force participation equation.

Once the sampling censor modifier (λ) is identified, we eliminate its importance in the estimation of market wages and accurately account for the relationship between wage offers and participation.

Under the assumption of the normality of e_o, e_1, and u [3/] the probability that a given individual participates is:

[3/]   The (u) is the disturbance term associated with $E(W_o | X_o, X_1, D = 1)$.

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$$(5) \quad P_i = \text{Prob} \; \frac{(B'_o \cdot X_o - B'_1 X_1 > u)}{\sigma_u} = \int_{-\infty}^{\theta} \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(t)^2} \, d(t)$$

where $\theta = \dfrac{B'_o \cdot X_o - B'_1 X_1}{\sigma_u}$

The Probit likelihood function for data consisting of n observations on individuals, s of whom are participants in the labor force, is:

$$(6) \quad L = \prod_{i=1}^{s} P_i \prod_{i=s+1}^{m} (1 - P_i)$$

with the form of P_i given in equation (5). Probit analysis generates maximum likelihood estimates of $\dfrac{B'_o}{\sigma_u}$ and $\dfrac{B'_1}{\sigma_u}$ for the elements appearing only in either X_o or X_1. Maximizing the likelihood function using W_o instead of $B'_o X_o$ enables one to retrieve consistent estimates of $\dfrac{1}{\sigma_u}$ and $\dfrac{B'_1}{\sigma_u}$. The coefficient on the wage rate in the Probit equation is the estimate of $\dfrac{1}{\sigma_u}$. From these estimates a consistent estimate of the mean reservation wage conditional upon the values of X_1 can be computed. From these estimates the distribution of reservation wages is calculated.

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Persons who are wage available need not be qualified for work in a particular job category. For example, although a person with a high school education is likely to be wage available for a chemical scientist's position he clearly does not possess the education necessary to effectively function in (i.e., qualify for) such a position. To account for such job performance considerations it would be ideal to have valid qualification testing scores on all persons. Given that the ideal is infeasible, approximations or proxies for job skills are used in the ALP model.

A specific subset of characteristics (X_{o_j}, X_{1_j}) for each job catetory (j) has been identified from historical personnel records of the Navy. A distribution of acceptable values (i.e., education completed, work force experience, etc.) will then be used to allign the wage available pool with specific job considerations. A wide range of proxies for work skill alignment factors are provided in the Data Parameters Section. Persons in the wage available force (across all sex/ethnic sub-groups) who possess acceptable (X_{o_j}, X_{1_j}) characteristics are said to belong to the available or relevant labor pool for job (j). EEO goals will be calculated for specific sex/ethnic subgroups of the designated relevant labor pool for job (j). These goals will then be projected for two time periods, one and five years into the future.

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DATA PARAMETERS

The data used to test the ALP model in the Navy application includes both public data (Current Population Survey (CPS), Survey of Income and Education (SIE), etc.) and Naval work force data. The public data is available from Paradigm's specially constructed data files and is essentially used in the calculation of reservation wages for non-full time, full year workers. The Navy's work force data is used for participation testing as well as geographic area and qualification specifications for job categories.

a. Data Parameters: Public

The following data on individuals sampled in Bureau of the Census Surveys within selected geographic areas is being utilized:

- Current Employment Status (full time, full year/not full time, full year workers)
- Year of Education Completed
- Sex
- Age (in years)
- Race (white, not white)
- Race (black, not black)
- Race (other, not other)
- Ethnic (Spanish speaking, not Spanish speaking)

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- Children 1 (number of children less than 6 years of age)

- Children 2 (number of children 7 to 13 years of age)

- Children 3 (number of children 14 to 18 years of age)

- Income of other workers in the household

- Estimated Hourly Wage

- Sampling Censor Modifier (λ)

- Predicted General Work Experience

- Occupation and Industry Codes (general Census code classifications)

The theoretical importance of these characteristics (or variables) in the determination of labor force participation is reported in the articles/publications presented in the bibliography.

b. Data Parameters: Navy

To ascertain the likelihood that persons will be wage available for a particular job (j) using the ALP model it is necessary to gather wage and compensation data. In addition, to determine appropriate labor supply alignment factors (X_{o_j}, X_{1_j}) specific historical personnel data is needed. The following is a list of data elements used for each job category within the specified geographic area for specific testing periods:

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- Average Hourly Wage

- Starting Hourly Wage

- Top Hourly Wage

- Monetary Value of Benefits or Other Forms of Compensation

- Number of Years of Education completed at time of Entrance to the Job Classification

- Vocational Education Completed at time of Entrance to Job Classification

- Occupations of Entrants to Navy Jobs Prior to Navy Position (Code Categories Census/Department of the Navy Occupation Level (DONOL))

- DONOL Occupation Specific Work Experience of Entrants to Navy at Time of Entrance

- General Work Experience (all jobs) of Entrants to Navy Jobs at Time of Entrance

- Age, in years of Entrants to Jobs at Time of Entrance

- Zip code at time of entrance to job category

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APPENDIX B

EEO GOALS SYSTEM - GOALS, CALCULATIONS AND
ADJUSTMENT RULES FOR ATTRITION, SMALL CELL
PROBLEMS, AND INTERNAL LABOR MARKETS

RULE 1: Calculate change in total workforce for each occupation level group. The sum of the workload goals of the occupation-level groups will be balanced to equal the total projected end-strength. A fair-share of this change will be applied to all ethnosexual (race-sex) groups using their percentages of the available labor pool. Ties will be broken by using a computerized random number routine.

RULE 2: The most important goals are the five-year goals. Intermediate goals will be interpolated using the current population as the base.

RULE 3: Adjustments of the five-year goals for attrition will be made as follows:

   a.   Only those categories where the numbers of the current incumbents is above goal will be examined. The maximum adjustment will be to the goal.

   b.   No downward change will be greater than one-half of the cumulative general attrition rate for occupation-level category under consideration.

   c.   Residuals will be subtacted from those goals where the current population is under goal on a fair-share basis such that the grand-total for each occupation-level group is maintained.

RULE 4: In order to account for small cell considerations (i.e., statistical estimation errors, current incumbents in small occupation-level groups, and provision for consideration of all ethnosexual groups) the following adjustments are to be made:

   a.   In categories where the occupation-level groups have 19 or fewer jobs, the goals will reflect the current incumbents with the only changes made to reflect changes in the workload. If the five-year workload requirements are higher, the additional jobs will be added to those categories furthest away from available labor force goals. If the five-year workload requirements are less, the current incumbent numbers will be reduced on a fair-share basis.

b. For occupation-level groups with 50 or fewer jobs and the external labor market for a given ethnosexual group is 2% or less, fractional amounts will be rounded up to the next integer.

c. For occupation-level groups with 51 or more jobs, rounding will be accomplished using the midpoint to determine the direction.

RULE 5: For the ungraded craftsmen and operative categories the following applies:

a. For external entry levels (i.e., apprentices and helpers) the available labor pool data will be used to calculate the goals including the necessary attrition calculations.

b. For journeymen where the number of current incumbents is less than the goals calculated by the available labor pool percentages, the five-year goals will equal the number of current incumbents plus five times the sum of the current apprentice incumbents multiplied by the promotion rate into journeymen and the number of helper incumbents multiplied by the promotion rate into journeymen. For these categories the calculated number will be checked against the goal developed using the available labor pool data. If the calculated number is greater, the goal will be set at the available labor pool goal number. The available labor pool data with any necessary attrition calculations will be used for those ethnosexual categories where the current incumbents are at or above the available labor pool goals. The residuals from the journeymen goals will be spread on a fair-share basis to the categories at or above the available labor pool goals.

c. The leader and supervisor five-year goals will be set using the assumption that an individual must be part of the current population of journeymen to be considered. Goals will be set to reflect the percentage that the total number of current incumbent leaders and supervisors are of the total number of current incumbent journeymen. In order to ensure that the number of jobs allocated is less than or equal to the current journeymen incumbents in a given ethnosexual category, a two stage process will be used. The first stage consists of multiplying the percentage of total number of incumbent leaders and supervisors to the total number of incumbent

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journeymen by the current number of incumbent journeymen in a particular ethnosexual category. This constitutes the pool of leader and supervisor jobs to be allocated. Then, the ratio of total number of leaders to the sum of the total number of leaders and total number of supervisors is calculated. The pool for a particular ethnosexual category is multiplied by this ratio to determine the number of leaders. Fractional amounts of categories with 50 or fewer journeymen are rounded up. The remainder in the pool is allocated to the supervisor jobs. The available labor pool data with any necessary attrition calculations will be used for those ethnosexual categories where the current incumbents are at or above the available labor pool goals. The residuals will be spread on a fair-share basis to the categories at or above the available labor pool goals. The external labor market supply ratios will be used to spread the residuals in the fair share routine.

RULE 6: A final check will be made to ensure that the sum of the goals for each of the ethnosexual categories equals the grand-total for each occupation-level group. If the sum is greater, the difference will be subtracted from the goal where the current population is farthest under the goal. If the sum is less, the difference will be added to the goal where the current population is farthest over the goal.